REMARKS

The Office Action dated June 1, 2004, has been received and carefully noted. The above amendments, and the following remarks, are submitted as a full and complete response thereto.

Claims 1, 3, 9 and 13 have been amended to more particularly point and distinctly claim the subject matter of the invention. Claim 14 has been cancelled, without prejudice. No new matter has been added. Claims 1-13 and 15-17 presently are pending in the application, and respectfully submitted for consideration.

Claims 1-8 were rejected under 35 U.S.C. § 112, first paragraph, as allegedly "not reasonably providing enablement for a synchronization ratio relative to a constant backwards speed V of a screw." The Office Action took the position that the specification allegedly does not enable a person skilled in the art to which it pertains, or with which it is most nearly connected, to carry out the invention commensurate in scope of the claims. Applicant respectfully traverses the rejection.

Applicant submits that support exists for the features of the claims and that the specification provides enablement to carry out the invention. Applicant refers, for example, to the specification on page 7, lines 10-17 and lines 23-26. Applicant submits that at least this discussion in the specification provides enablement for a synchronization ratio in relation to a constant backwards speed of a screw by describing a synchronization ratio in relation to a backwards speed of screw 20. Accordingly, the backwards speed of

screw 20 has a constant speed when the synchronization ratio is 100%. This synchronization ratio can be set. Applicant maintains that this discussion provides enablement of a synchronization ratio relative to a constant backwards speed of a screw. Thus, applicant respectfully requests that the rejection under Section 112, first paragraph, be withdrawn.

Claim 9 was rejected under 35 U.S.C. §103(a) as allegedly anticipated by U.S. Patent No. 6,321,940 (*Imatomi*). The Office Action took the position that the cited reference taught or suggested all the features of claim 9. Applicant respectfully traverses the rejection.

Applicant notes that *Imatomi* is assigned to the assignee of the present application, and that, at the time of the invention, applicant was under an obligation to assign the present invention to the assignee, Sumitomo Heavy Industries, Ltd. As noted on the Notice of Recordation of Assignment Document dated January 16, 2002, the current assignee of the present application is Sumitomo Heavy Industries, Ltd., and the assignment is recorded at reel 012307, frame 0944. Applicant also notes that *Imatomi* qualifies as a reference only under 35 U.S.C. § 102(e). Thus, according to 35 U.S.C. § 103(c), *Imatomi* is not available as to preclude patentability under Section 103(a). Therefore, the rejection is rendered moot, and applicant respectfully requests that the obviousness rejection of claim 9 be withdrawn.

Claims 1-12 were rejected under 35 U.S.C. § 103(a) as allegedly rendered obvious by U.S. Patent No. 4,879,077 (*Shimizu et al.*) in view of U.S. Patent No. 4,450,359

(*Yamazaki*). Further, claims 13 and 15-17 also were rejected under 35 U.S.C. § 103(a) as allegedly rendered obvious by *Shimizu* in view of *Yamazaki*. The Office Action took the position that *Shimizu* does not disclose backward movement of the rotating screw. The Office Action then took the position that *Yamazaki* taught the features of the claims missing from *Shimizu*. Applicant respectfully submits that the cited references do not disclose or suggest all the features of any of the presently pending claims.

Claim 1, upon which claim 2 is dependent, presently recites a method for controlling an injection molding machine including a heating cylinder and a screw disposed in the heating cylinder, and performing a plasticization/measuring process and an injecting process. The method includes defining a synchronization ratio S of a rotation speed of the screw to be 100% when the position of a flight thereof does not apparently move relative to a constant backward speed V of the screw. The method also includes moving the screw backwards at the constant backward speed V while rotating it after completion of the measuring process or the injecting process. A rotation speed R of the screw during the backward movement is given by multiplying the rotation speed R, which is expressed by the equation R = backward speed V/pitch P of the flight, by an arbitrary synchronization ratio Sx.

Claim 3, upon which claim 4 is dependent, presently recites a method for controlling an injection molding machine including a heating cylinder, a screw disposed in the heating cylinder, a first driving source for driving the screw in an axial direction, a second driving source for rotating the screw, position detecting means for detecting an

axial position of the screw, rotation-speed detecting means for detecting the rotation speed of the screw, and a controller for controlling the first driving source and the second driving source dependent on the detecting signals transmitted from the position detecting means and the rotation-speed detecting means, and performing a plasticization/measuring process and an injecting process. The method includes defining a synchronization ratio S of a rotation speed of the screw to be 100% when the position of a flight thereof does not apparently move relative to a constant backward speed V of the screw. The controller moves the screw backwards at the constant backward speed V while rotating it after the completion of the measuring process or the injecting process. A rotation speed R of the screw during the backward movement is given by multiplying the rotation speed R, which is expressed by the equation, R = backward speed V/pitch P of the flight, by an arbitrary synchronization ratio Sx.

Claim 5, upon which claim 6 is dependent, presently recites a method for controlling an injection molding machine in order to perform a resin plasticization/measuring process and an injecting process. The injection molding machine includes a heating cylinder and a screw having a flight of a pitch P. The screw is arranged within the heating cylinder. The method includes defining a synchronization ratio S with reference to a rotation speed R and a constant linear backward speed V of the screw. The synchronization ratio S is equal to 100% when the flight does not apparently move while the screw is rotated and linearly moved backwards. The synchronization ratio S is smaller than 100% when the flight moves backwards while the screw is rotated

and linearly moved backwards. The synchronization ratio S is greater than 100% when the flight moves forwards while the screw is rotated and linearly moved backward. The method also includes making the screw linearly move backward at a selected synchronization ratio Sx and simultaneously rotate after completion of the plasticization/measuring process or the injecting process. A selected rotation speed Rs of the screw is given by: Rs = (V/P) x Sx.

Claim 7, upon which claim 8 is dependent, presently recites a method for controlling an injecting molding machine in order to perform a resin plasticization/measuring process and injection process having some of the features recited in claim 5.

Claim 9, upon which claims 10-12 are dependent, presently recites a method for controlling an injection molding machine in order to control the movement of a molten resin in a heating cylinder of the injection molding machine. The injection molding machine includes a screw arranged within the heating cylinder to be rotatable and to be linearly movable, and having a flight of a pitch P. The molten resin is moved in a forward feeding direction during a plasticization process and an injecting process. The method includes the step of linearly moving the screw backwards relative to the forward feeding direction of the molten resin at a constant backward speed and simultaneously rotating the screw in the forward feeding direction at a rotation speed corresponding to the constant backward speed, after completion of the plasticization process or the injecting process.

Claim 13, upon which claims 15-17 are dependent, presently recites a method for controlling an injection molding machine in order to control the movement of a molten resin by a screw in a heating cylinder of the injection molding machine. The screw is arranged within the heating cylinder to be rotatable and to be linearly moveable. The molten resin is moved in a forward feeding direction during a plasticization process and an injecting process. The method includes rotating the screw in the forward feeding direction at a rotation speed R and simultaneously and linearly moving the screw backwards relative to the forward feeding direction of the molten resin at a constant backward speed V.

As discussed in the specification, examples of the present invention enable the screw to be moved backward at the constant speed V after completion of the measuring process or the injecting process. The rotation speed R of the screw during the backward movement is controlled based on the equation $R=(V/P) \times Sx$. The backward movement of the screw at the constant backward speed V controls the density distribution of the molten resin in the heating cylinder, particularly at the nose portion of the screw. Further, examples of the present invention control the density distribution of the molten resin in the heating cylinder, particularly at the nose portion of the screw, even if a bad bite state of the resin pellet or low viscosity of the molten resin occurs. Further, measuring steps are performed at the constant rotation speed irrespective of the pressure of the resin when the screw moves backward at the constant speed, and differs from maintaining a constant pressure of the resin. Thus, variations in the weight of the molded

products may be reduced. It respectfully is submitted that the cited references, either alone or in combination, do not disclose or suggest all the features of any of the presently pending claims. Therefore, the cited references do not provide the critical and unobvious advantages described above.

Shimizu relates to a control method of an injection molding machine. *Shimizu* describes that screw 2 is rotated in the reverse direction to the rotational direction in the measuring process at the same time when screw 2 is moved forward in the injection process. The apparent position of ridge 2h or groove 2d of screw 2 in a predetermined position of the heating cylinder becomes substantially stationary. Referring to Figure 3(b) of *Shimizu,* a motor for rotation is driven and a motor for injection is not driven in the measuring process. *Shimizu* also describes that slight backward movement from this position can be allowed. Further, a predetermined speed can be set by, for example, R = VS/L, where VS is a forward moving speed of the screw. *Shimizu*, however, does not disclose or suggest the feature of moving the screw backwards at a constant backward speed V while rotating it after completion of the measuring process or the injecting process.

Yamazaki relates to an injection molding machine. *Yamazaki* describes a resin that is molten and plasticized by injection heating cylinder 21. Referring to Figure 1 of *Yamazaki*, the molten resin is accumulated within the nose portion of injection screw 20 by the rotation of injection screw 20. During the rotation of injection screw 20, injection screw 20 retreats backward. The retreat movement force is caused by the back pressure

from the accumulated molten resin. The retreat movement force also serves as the rotation force to threaded shaft 23. The rotation of threaded shaft 23 is restricted by back pressure control device 29 having a brake through rotary shaft 24, so that the back pressure can be controlled. Because injection screw 20 retreats backward from the back pressure of the accumulated resin, it is difficult to obtain the retreat movement force that is sufficient to move injection screw 20 if the density of the molten resin is low. The rotation of the screw of *Yamazaki* is due to the back pressure of the molten resin. *Yamazaki*, however, does not disclose or suggest constant backward speed of the screw by moving the screw backwards by rotating it after completion of the measuring process or the injecting process, wherein a rotation speed of the screw defined by the constant backward speed during the backward movement is given.

In contrast, claim 1 recites "moving the screw backwards at the constant backward speed V while rotating it after completion of the measuring process or the injecting process." Claim 3 recites "a controller for controlling the first driving source and the second driving source . . . wherein the controller moves the screw backwards at the constant backward speed V while rotating it after the completion of the measuring process or the injecting process." Claim 5 recites "making the screw linearly move backward at a selected synchronization ratio Sx and simultaneously rotate after completion of the plasticization/measuring process or the injecting process." Independent claims 7, 9, and 13 also recite some of the features of the claims described

above. Applicant submits that the cited references, either alone or in combination, do not disclose or suggest all the features of the pending claims.

With regard to claims 1-8, the Office Action took the position that the limitation of constant speed in the defining step was addressed as non-functional descriptive material, as it pertains to computer-related inventions. Apparently, this limitation of the pending claims was not, therefore, given any patentable weight. Applicant submits, on the contrary, that the recited limitation is functional limitation and the features of the present claims are distinguishable from the cited references in terms of patentability because the limitations alter how steps are to be performed to achieve the invention. Applicant submits that defining a synchronization ratio of a rotation speed of the screw to be 100% when the position of a flight does not move relative to a constant backwards speed of the screw alters how the steps recited in the claims are to be performed when practicing the invention. Thus, this limitation must be given patentable weight when determining patentability. See MPEP § 2106 VI.

As recited in claim 1, the synchronization ratio is defined to be 100% when the position of a flight thereof does not apparently move relative to a constant backwards speed of a screw. A constant backwards speed is functional descriptive material as it does alter how the step is executed and must be considered and addressed in assessing patentability under 35 U.S.C. § 103(a). The Office Action did not provide any aspects of the cited references that disclose or suggest these features, and no such disclosure or suggestion is, in fact, contained in the cited references. Applicant also notes that

independent claims 1, 3, 5 and 7 recite a method for controlling and are not limited to computer-related inventions. Therefore all the limitations of these claims must be given patentable weight and considered in determining patentability. Applicant submits that at least these features are not disclosed or suggested by the cited references, either alone or in combination.

Applicant also submits that the cited references, either alone or in combination, do not disclose or suggest moving the screw backwards at a constant backward speed V while rotating it after completion of the measuring process or the injecting process. The cited references also do not disclose or suggest, either alone or in combination, a controller for controlling a first drive source and a second drive source to move the screw backwards at the constant backward speed V. Referring to *Shimizu*, the screw might retreat backward in the measuring process. The retreat speed of the screw, however, is not constant. Further, the motor for injection is not driven in the measuring process. Thus, *Shimizu* does not control the density distribution of the molten resin in the heating cylinder, particularly at the nose portion of the screw. Therefore, *Shimizu* does not disclose or suggest moving the screw backwards at a constant speed V while rotating it after completion of the measuring process or the injecting process.

Referring to *Yamazaki*, the injection screw thereof retreats backward during rotation. The retreat movement force is caused by the back pressure from the accumulated molten resin. Because the injection screw retreats backward by the back pressure of the accumulated resin, the retreat movement force is insufficient to move the

injection screw when the density of the molten resin is low. As noted above, measuring according to the present invention is performed irrespective of the pressure of the resin. Thus, the density of the molten resin of *Yamazaki* has to exceed the friction resistance force caused by the injection screw, the threaded shaft, and the like to enable any retreat movement force. Due to this aspect, *Yamazaki* does not suitably control the density distribution of the molten resin in the heating cylinder. As noted above, measuring according to the present invention is performed irrespective of the pressure of the resin. Thus, *Yamazaki* does not disclose or suggest moving the screw backwards at the constant speed V while rotating it after completion of the measuring process or the injecting process.

Applicant also submits that *Yamazaki* does not disclose or suggest a rotation speed R being controlled in correspondence to the constant backward speed V of the screw. According to *Yamazaki*, the back pressure is controlled by the restriction of the retreat movement force or the restriction of the rotation of the threaded shaft by the friction force of the brake. The back pressure, and not the speed of the injection screw, is the focus of the process described in *Yamazaki*. Thus, the retreat movement speed of the injection screw is not kept constant, even if the retreat movement of the injection screw is restricted by use of the brake. Thus, *Yamazaki* does not disclose or suggest those features of the pending claims missing from *Shimizu*.

Applicant maintains that the cited references, either alone or in combination, do not disclose or suggest all the features of the independent claims. Applicant also submits

that the dependent claims are distinguishable from the cited references at least due to their dependence on the independent claims. Thus, applicant respectfully requests that the obviousness rejection be withdrawn.

It is further submitted that each of the claims 1-13 and 15-17 recites subject matter that is neither disclosed nor suggested by the cited references, either alone or in combination. It is therefore respectfully requested that all of claims 1-13 and 15-17 be found allowable, and that this application be passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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